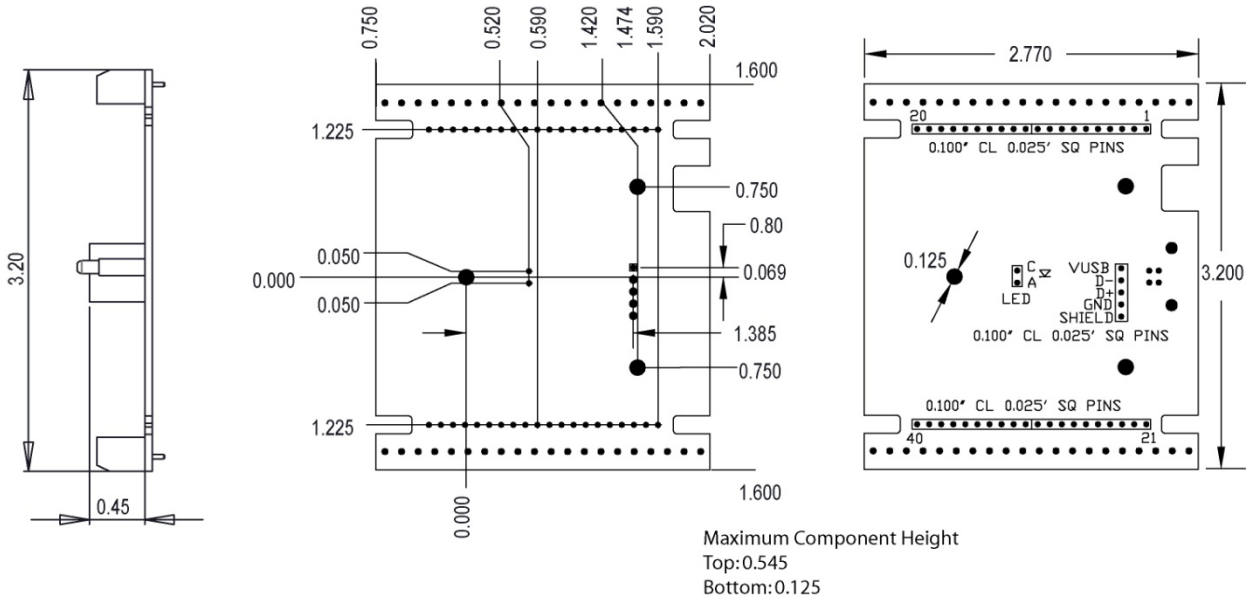
Mechanical drawings



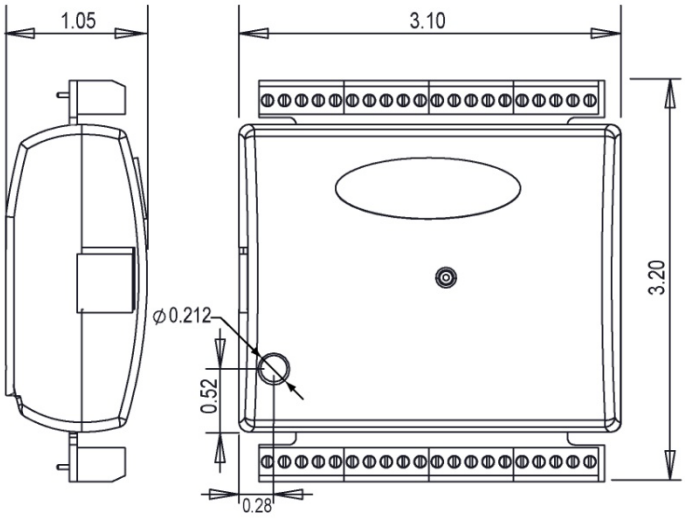


Figure 15. Circuit board (top) and enclosure dimensions

Specifications

All specifications are subject to change without notice.
Typical for 25°C unless otherwise specified.
Specifications in *italic text* are guaranteed by design.

Analog input

Table 1. Analog input specifications

Parameter	Condition	Specification
A/D converter type		Successive approximation type
Input voltage range for linear operation	CHx to GND	Single-ended mode: ±10 V max Differential mode: –10 V min, +20 V max
Absolute maximum input voltage	*CHx to GND*	*±28 V max*
Input impedance		*122 kΩ*
Input current (Note 1)	V_{in} = +10 V	70 µA typ
	V_{in} = 0 V	–12 µA typ
	V_{in} = –10 V	–94 µA typ
Number of channels		8 single-ended or 4 differential; software-selectable
Input ranges	Single-ended	±10 V, G=2
	Differential	±20 V, G=1 ±10 V, G=2 ±5 V, G=4 ±4 V, G=5 ±2.5 V, G=8 ±2.0 V, G=10 ±1.25 V, G=16 ±1.0 V, G=20 Software-selectable
Throughput (Note 2)	Software paced	250 S/s typ, PC-dependent
	Hardware paced	0.014 S/s to 50 kS/s
Channel gain queue		Software selectable. 8 elements in SE mode, 4 elements in DIFF mode. One gain element per channel. Elements must be unique and listed in ascending order.
Resolution (Note 3)	Differential	12 bits, no missing codes
	Single-ended	11 bits
Integral linearity error		±1 LSB typ
Differential linearity error		±0.5 LSB typ
Repeatability		±1 LSB typ
Trigger source	Software-selectable	External digital: TRIG_IN Software-selectable
Pacer source	Software-selectable	■ Internal ■ External (SYNC), rising edge triggered Software-selectable

Note 1: Input current is a function of applied voltage on the analog input channels. For a given input voltage, V_{in}, the input leakage is approximately equal to (8.181 * V_{in} – 12) µA.

Note 2: Maximum throughput when scanning is machine dependent.

Note 3: The AD7870 converter only returns 11 bits (0 to 2,047 codes) in single-ended mode.

Accuracy

Table 2. Accuracy, differential mode

Range	Accuracy (LSB)
±20 V	5.1
±10 V	6.1
±5 V	8.1
±4 V	9.1
±2.5 V	12.1
±2 V	14.1
±1.25 V	20.1
±1 V	24.1

Table 3. Accuracy, single-ended mode

Range	Accuracy (LSB)
±10 V	4.0

Table 4. Accuracy components, differential mode – all values are (±)

Range	% of Reading	Gain Error at FS (mV)	Offset (mV)	Accuracy at FS (mV)
±20 V	0.2	40	9.766	49.766
±10 V	0.2	20	9.766	29.766
±5 V	0.2	10	9.766	19.766
±4 V	0.2	8	9.766	17.766
±2.5 V	0.2	5	9.766	14.766
±2 V	0.2	4	9.766	13.766
±1.25 V	0.2	2.5	9.766	12.266
±1 V	0.2	2	9.766	11.766

Table 5. Accuracy components, single-ended mode – all values are (±)

Range	% of Reading	Gain Error at FS (mV)	Offset (mV)	Accuracy at FS (mV)
±10 V	0.2	20	19.531	39.531

Noise performance

Table 6. Noise performance, differential mode

Range	Typical counts	LSB_{rms}
±20 V	2	0.30
±10 V	2	0.30
±5 V	3	0.45
±4 V	3	0.45
±2.5 V	4	0.61
±2 V	5	0.76
±1.25 V	7	1.06
±1 V	8	1.21

Table 7. Noise performance, single-ended mode

Range	Typical counts	LSB_{rms}
±10 V	2	0.30

Analog output

Table 8. Analog output specifications

Parameter	Condition	Specification
Resolution		12-bits, 1 in 4,096
Output range		*0 V to 5.0 V*
Number of channels		2
Throughput (Note 4)	Software paced	250 S/s single channel typ, PC dependent
	Hardware paced	50 kS/s max per channel
Power on and reset voltage		Initializes to 000h code
Output drive	Each D/A OUT	5 mA, sourcing
Slew rate		0.8 V/ µs typ

Note 4: Maximum throughput when scanning is machine dependent.

Table 9. Analog output accuracy, all values are (±); accuracy tested at no load

Range	Accuracy (LSB)
0 V to 5.0 V	4.0 typ, 45.0 max

Table 10. Analog output accuracy components, all values are (±)

Range	% of FSR	Gain Error at FS (mV)	Offset (mV) (Note 5)	Accuracy at FS (mV)
0 V to 5.0 V	0.1 typ, 0.9 max	4.0 typ, 36.0 max	1.0 typ, 9.0 max	4.0 typ, 45.0 max

Note 5: Zero-scale offsets may result in a fixed zero-scale error producing a "dead-band" digital input code region. In this case, changes in digital input code at values less than 0x040 may not produce a corresponding change in the output voltage. The offset error is tested and specified at code 0x040.

Digital input/output

Table 11. Digital I/O specifications

Parameter	Specification
Digital type	CMOS
Number of I/O	16 (Port A0 through A7, Port B0 through B7)
Configuration	2 banks of 8. Port B is high current drive.
Pull up/pull-down configuration	All pins pulled up to 5V via 47 kΩ resistors (default). Change to pull-down using internal user-configurable jumpers.
Input high voltage threshold	2.0 V min
Input high voltage limit	5.5 V absolute max
Input low voltage threshold	0.8 V max
Input low voltage limit	–0.5 V absolute min 0 V recommended min
Output high voltage, Port A	4.4 V min (IOH = –20 µA) 3.84 V min (IOH = –6.0 mA)
Output low voltage, Port A	0.1 V max (IOL = 20 µA) 0.33 V max (IOL = 6.0 mA)
Output high voltage, Port B	4.4 V min (IOH = –50 µA) 3.76 V min (IOH = –24.0 mA)
Output low voltage, Port B	0.1 V max (IOH = 50 µA) 0.44 V max (IOH = 24.0 mA)
Power on and reset state	Input

External trigger

Table 12. Digital trigger specifications

Parameter	Specification
Trigger source (Note 7)	External digital; TRIG_IN terminal
Trigger mode	Edge sensitive; software-selectable for CMOS compatible rising or falling edge, high or low level.
Trigger latency	10 µs max
Trigger pulse width	1 µs min
Input type	Schmitt trigger, 47 kΩ pull-down to ground
Schmitt trigger hysteresis	1.01 V typ 0.6 V min 1.5 V max
Input high voltage threshold	2.43 V typ 1.9 V min 3.1 V max
Input high voltage limit	5.5 V absolute max
Input low voltage threshold	1.42 V typ 1.0 V min 2.0 V max
Input low voltage limit	–0.5 V absolute min 0 V recommended min

External clock input/output

Table 13. External clock I/O specifications

Parameter	Condition	Specification
Terminal name		SYNC
Terminal type		Bidirectional
Direction (software-selectable)	Output	Outputs the internal A/D pacer clock
	Input (default)	Receives A/D pacer clock from external source
Input clock rate		50 kHz, max
Clock pulse width	Input mode	1 µs min
	Output mode	5 µs min
Input type		Schmitt trigger, 47 kΩ pull-down to ground
Schmitt trigger hysteresis		1.01 V typ 0.6 V min 1.5 V max
Input high voltage threshold		2.43 V typ 1.9 V min 3.1 V max
Input high voltage limit		5.5 V absolute max
Input low voltage threshold		1.42 V typ 1.0 V min 2.0 V max
Input low voltage limit		–0.5 V absolute min 0 V recommended min
Output high voltage		4.4 V min (IOH = –50 µA) 3.80 V min (IOH = –8 mA)
Output low voltage		0.1 V max (IOL = 50 µA) 0.44 V max (IOL = 8 mA)

Counter

Table 14. Counter specifications

Parameter	Specification
Pin name	CTR
Counter type	Event counter
Number of channels	1
Input type	Schmitt trigger, 47 kΩ pull-down to ground, rising edge triggered
Input source	*CTR screw terminal*
Resolution	32 bits
Maximum input frequency	1 MHz
High pulse width	*500 ns min*
Low pulse width	*500 ns min*
Schmitt trigger hysteresis	1.01 V typ 0.6 V min 1.5 V max
Input high voltage threshold	2.43 V typ 1.9 V min 3.1V max
Input high voltage limit	5.5 V absolute max
Input low voltage threshold	1.42 V typ 1.0 V min 2.0 V max
Input low voltage limit	–0.5 V absolute min 0 V recommended min

Memory

Table 15. Memory specifications

Non-volatile EEPROM	2,048 bytes (768 bytes calibration, 256 bytes user, 1,024 bytes DAQFlex)

Microcontroller

Table 16. Microcontroller specifications

Type	*High performance 16-bit RISC microcontroller*

Power

Table 17. Power specifications

Parameter	Condition	Specification
Supply current	During USB enumeration	< 100 mA
	After USB enumeration, including DIO, AO, SYNC, and +VO output loading	< 500 mA
+VO power available	After USB enumeration	4.5 V min, 5.25 V max
+VO output current	After USB enumeration	100 mA max

General

Table 18. General specifications

Parameter	Specification
Device type	USB 2.0 full speed
Device compatibility	USB 1.1, USB 2.0

Environmental

Table 19. Environmental specifications

Parameter	Specification
Operating temperature range	0 °C to 70 °C
Storage temperature range	–40 °C to 70 °C
Humidity	0% to 90% non-condensing

Mechanical

Table 20. Mechanical specifications

Parameter	Specification
Dimensions (L × W × H)	79 × 82 × 27 mm (3.10 × 3.20 × 1.05 in.)
USB cable length	3 m (9.84 ft) max
User connection length	3 m (9.84 ft) max

Signal connector

Table 21. Screw terminal specifications

Parameter	Specification
Connector type	Screw terminal
Wire gauge range	16 AWG to 30 AWG

Differential mode pinout

Table 22. 4-channel differential mode pinout

Pin	Signal name	Pin description	Pin	Signal name	Pin description
1	CH0 IN HI	Analog input 0+	21	Port A0	Port A bit 0
2	CH0 IN LO	Analog input 0–	22	Port A1	Port A bit 1
3	AGND	Analog ground	23	Port A2	Port A bit 2
4	CH1 IN HI	Analog input 1+	24	Port A3	Port A bit 3
5	CH1 IN LO	Analog input 1–	25	Port A4	Port A bit 4
6	AGND	Analog ground	26	Port A5	Port A bit 5
7	CH2 IN HI	Analog input 2+	27	Port A6	Port A bit 6
8	CH2 IN LO	Analog input 2–	28	Port A7	Port A bit 7
9	AGND	Analog ground	29	GND	Ground
10	CH3 IN HI	Analog input 3+	30	+VO	Power output
11	CH3 IN LO	Analog input 3–	31	GND	Ground
12	AGND	Analog ground	32	Port B0	Port B bit 0
13	D/A OUT 0	Analog output 0	33	Port B1	Port B bit 1
14	D/A OUT 1	Analog output 1	34	Port B2	Port B bit 2
15	AGND	Analog ground	35	Port B3	Port B bit 3
16	Reserved	Reserved for future use	36	Port B4	Port B bit 4
17	GND	Ground	37	Port B5	Port B bit 5
18	TRIG_IN	Trigger input	38	Port B6	Port B bit 6
19	SYNC	Synchronization I/O	39	Port B7	Port B bit 7
20	CTR	Counter input	40	GND	Ground

Single-ended mode pinout

Table 23. 8-channel single-ended mode pinout

Pin	Signal name	Pin description	Pin	Signal name	Pin description
1	CH0 IN	Analog input 0	21	Port A0	Port A bit 0
2	CH1 IN	Analog input 1	22	Port A1	Port A bit 1
3	AGND	Analog ground	23	Port A2	Port A bit 2
4	CH2 IN	Analog input 2	24	Port A3	Port A bit 3
5	CH3 IN	Analog input 3	25	Port A4	Port A bit 4
6	AGND	Analog ground	26	Port A5	Port A bit 5
7	CH4 IN	Analog input 4	27	Port A6	Port A bit 6
8	CH5 IN	Analog input 5	28	Port A7	Port A bit 7
9	AGND	Analog ground	29	GND	Ground
10	CH6 IN	Analog input 6	30	+VO	Power output
11	CH7 IN	Analog input 7	31	GND	Ground
12	AGND	Analog ground	32	Port B0	Port B bit 0
13	D/A OUT 0	Analog output 0	33	Port B1	Port B bit 1
14	D/A OUT 1	Analog output 1	34	Port B2	Port B bit 2
15	AGND	Analog ground	35	Port B3	Port B bit 3
16	Reserved	Reserved for future use	36	Port B4	Port B bit 4
17	GND	Ground	37	Port B5	Port B bit 5
18	TRIG_IN	Trigger input	38	Port B6	Port B bit 6
19	SYNC	Synchronization I/O	39	Port B7	Port B bit 7
20	CTR	Counter input	40	GND	Ground

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